

E85
85% Ethanol

www.E85Fuel.com

\$ Price per gallon (including tax)

30.99



UNLEADED

\$ Price per gallon (including tax)

34.79



UNLEADED PLUS

\$ Price per gallon (including tax)

35.79



SUPER UNLEADED

\$ Price per gallon (including tax)

36.79



Wayne

Finding the Right Biomass **FUEL**

E85
85% Ethanol
www.E85Fuel.com

\$ Price per gallon (including tax)

30.99

E85
85% Ethanol
PUSH HERE

UNLEADED

\$ Price per gallon (including tax)

34.79

MINIMUM OCTANE RATING
(R-MILZ METHOD)

87
PUSH HERE

UNLEADED PLUS

\$ Price per gallon (including tax)

35.79

MINIMUM OCTANE RATING
(R-MILZ METHOD)

89
PUSH HERE

SUPER UNLEADED

\$ Price per gallon (including tax)

36.79

MINIMUM OCTANE RATING
(R-MILZ METHOD)

92
PUSH HERE

Finding the Right Biomass

F — Feedstocks & Form

U — Utilization

E — Economics

L — Lessons

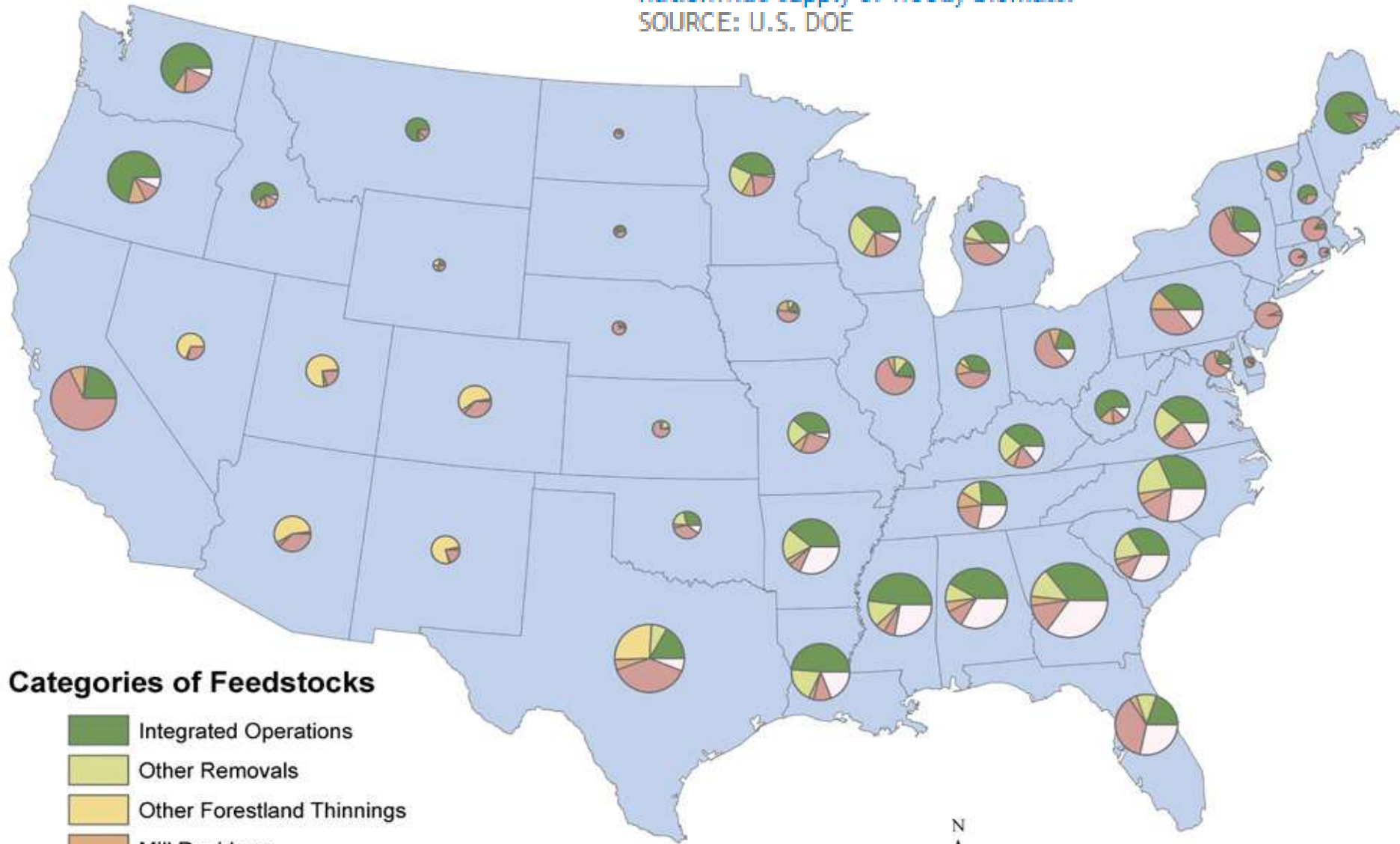
Feedstocks



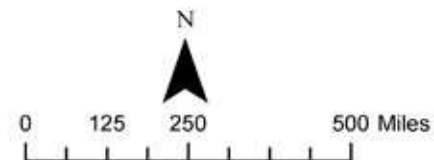


Jon Cambron
Kentucky State University
Frankfort, Kentucky

FINDING FEEDSTOCK: Researchers applied state-by-state analysis to determine biomass availability. This map shows the nationwide supply of woody biomass.
SOURCE: U.S. DOE



Categories of Feedstocks



Form















PARTNERS



DEDI
DEVELOPMENT & ECONOMIC
DIVERSITY INITIATIVE



MURRAY
STATE UNIVERSITY
Westwood School
of Agriculture

LEI-PRODUCTS
SUSTAINABLE ENVIRONMENTAL SOLUTIONS

RE
PREMIUM GRADE

**GH
TU**

Meets or exceeds

PREMIUM GRADE STANDARDS

Material	100% Hardwood
Ash	Less than 1%
Fines	Less than 0.5%
Sodium	Less than 300 PPM

Sample Log No:	W213-0719-01	Sample Date:	
Sample Designation:	40 Lb Pellet Bag	Sample Time:	
Sample Recognized As:	Pellets	Arrival Date:	7/16/2013

Test Results

	METHOD	UNITS	MOISTURE FREE	AS RECEIVED
Moisture Total	ASTM E871	wt. %		4.49
Ash	ASTM D1102	wt. %	0.34	0.33
Volatile Matter	ASTM D3175	wt. %		
Fixed Carbon by Difference	ASTM D3172	wt. %		
Sulfur	ASTM D4239	wt. %	0.009	0.009
SO ₂	Calculated	lb/mmbtu		0.020
Net Cal. Value at Const. Pressure	ISO 1928	GJ/tonne		
Net Cal. Value at Const. Pressure	ISO 1928	J/g		
Gross Cal. Value at Const. Vol.	ASTM E711	J/g	19930	19035
Gross Cal. Value at Const. Vol.	ASTM E711	Btu/lb	8569	8184
Carbon	ASTM D5373	wt. %		
Hydrogen*	ASTM D5373	wt. %		
Nitrogen	ASTM D5373	wt. %		
Oxygen*	ASTM D3176	wt. %		
*Note: As received values do not include hydrogen and oxygen in the total moisture.				
Chlorine	ASTM D6721	mg/kg	20	19
Fluorine	ASTM D3761	mg/kg		
Mercury	ASTM D6722	mg/kg		
Bulk Density	ASTM E873	lbs/ft ³		44.81
Fines (Less than 1/8")	TPT CH-P-06	wt. %		0.21
Durability Index	Kansas State	PDI		97.9
Sample Above 1.50"	TPT CH-P-06	wt. %		0.0
Maximum Length (Single Pellet)	TPT CH-P-06	inch		1.517
Diameter, Range	TPT CH-P-05	inch	0.253 to	0.257
Diameter, Average	TPT CH-P-05	inch		0.255
Stated Bag Weight	TPT CH-P-01	lbs		40.0
Actual Bag Weight	TPT CH-P-01	lbs		40.0

Comments



KINGSFORD

**Kingsford Manufacturing
Company**
Summer Shade, KY



Biomass Conversion Technology	Commonly used fuel types ^a	Particle Size Requirements	Moisture Content Requirements (wet basis) ^b	Average capacity range / link to examples
Stove/Furnace	Solid wood, pressed logs, wood chips and pellets	Limited by stove size and opening	10 – 30%	15 kWt to ?
Pile burners	Virtually any kind of wood residues ^c or agricultural residues ^d except wood flour	Limited by grate size and feed opening	< 65%	4 to 110 MWe
Pile burner fed with underfire stoker (biomass fed by auger below bed)	Sawdust, non-stringy bark, shavings, chips, hog fuel	0.25-2 in (6-38 mm)	10-50%	4 to 110 MWe
Stoker grate boilers	Sawdust, non-stringy bark, shavings, end cuts, chips, chip rejects, hog fuel	0.25 – 2 in (6 – 50 mm)	10-50% (keep within 10% of design rate)	20 to 300 MWe many in 20 to 50 MWe range
Suspension boilers Cyclonic	Sawdust, Non-stringy bark, shavings, flour, sander dust	0.25 in (6 mm) max	< 15%	many < 30 MWe
Suspension boilers, Air spreader-stoker	Wood flour, sander dust, and processed sawdust, shavings	0.04 – 0.25 in (1-1.6 mm)	< 20%	1.5 MWe to 30 MWe
Fluidized-bed combustor (FB- bubbling or CFB- circulating)	Low alkali content fuels, mostly wood residues or peat no flour or stringy materials	< 2 in (< 50 mm)	< 60%	Many at 20 to 25 MWe, up to 300 Example
Co-firing: pulverized coal boiler	Sawdust, non-stringy bark, shavings, flour, sander dust	<0.25 in (<6 mm)	< 25%	Up to 1500 MWee Example
Co-firing: cyclones	Sawdust, non-stringy bark, shavings, flour, sander dust	<0.5 in (<12 mm)	10 – 50%	40 to 1150 MWee Example
Co-firing: stokers, fluidized	Sawdust, non-stringy bark, shavings, flour, sander dust	< 3 in (<72 mm)	10 – 50%	MWee Example
Counter current, fixed bed (updraft) atmospheric	Chipped wood or crop fuel, rice hulls, rice straw, bagasse, sedge	0.25 – 4 in (6 – 100 mm)	< 20%	5 to 90 MWt, + up to 12 Mwe
Downdraft, moving bed atmospheric gasifier	Wood chips, shavings, wood scrap, nut shells	< 2 in (<50 mm)	<15%	~ 25-100 kWe Example
Circulating fluidized bed (CFB), dual vessel, gasifier	Most wood and chipped agricultural residues but no flour or stringy materials	0.25 – 2 in (6 –50 mm)	15-50%	~ 5 to 10 Mwe
Fast pyrolysis	Variety of wood and agricultural resources	0.04-0.25 in (1-6 mm)	< 10%	~ 2.5 MWe Example 1 Example 2
Anerobic digesters	Animal manures & bedding, food processing residues, brewery by-products, other industry organic residues	NA	65 to 99.9% liquid depending on type, i.e., 0.1 to 35% solids	145 to 1700 x 103 kWhr/yr Example

Source: http://cta.ornl.gov/bedb/biopower/Biomass_Power_Technology_Fuel_Specifications_and_Capacity_Range.xls

Compiled by Lynn Wright, Oak Ridge, TN.






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Safely Providing Steam
While Keeping Our Planet Green

DANGER
THIS MACHINE IS
AUTOMATICALLY
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IT MAY START AT ANY TIME.



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GATE 2







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FUEL VALUE CALCULATOR



USDA Forest Service • Forest Products Marketing

Located at Forest Products Laboratory • One Gifford Pinchot Drive • Madison, Wisconsin 53726

(1) Select your current fuel source below:

(2) Enter your cost below:

Natural gas

\$1.40

Your current cost per million Btu (mmBtu) is: —————→ **\$17.07** same for all below

Alternative fuel sources:	Moisture content	Dried Bomb Btu/lb	(3) Heating value:	Typical cost	Burning efficiency
Wood Green (50% MC) commercial boiler	50	8,600	\$99 /ton	\$30	67% ←
Wood Semidried (30% MC) commercial boiler	30	8,600	\$152 /ton	\$45	74% ←
Wood Air-dried (20% MC) commercial boiler	20	8,600	\$179 /ton	\$60	76% ←
EPA catalytic wood stove (20% MC) residential	20	8,600	\$169 /ton	\$60	72%
EPA non-cat residential wood stove (20% MC)		8,600	\$148 /ton	\$60	63%
Pre-1990 residential stove (20% MC)	20	8,600	\$127 /ton	\$60	54%
Wood Ovendried (0% MC) commercial boiler	0	8,600	\$233 /ton	\$130	79% ←
(4) YourNewFuel using typical boiler efficiency	40	8,600	\$125 /ton		71%
(5) YourNewFuel using your efficiency	40	8,600	\$70 /ton		40%
Wood pellets (premium 8% MC) commercial boiler	8	8,600	\$232 /ton	\$235	86%
EPA Residential pellet stoves (8%MC)	8	8,600	\$211 /ton	\$235	78%
Uncertified Residential pellet stove (8%MC)	8	8,600	\$176 /ton	\$235	65%
Natural gas			\$1.40 /therm		80%
Electricity (insert heatpump COP = 1)		1	\$0.057 /kWh	\$0.18	98%
Firewood (seasoned 20% MC) commercial boiler			\$261 /cord	\$200	77%
Switch grass (oven dried) commercial boiler	0	7,750	\$212 /ton		80%
Bituminous coal commercial boiler	0	15,300	\$444 /ton		85%
Shelled corn (15% MC) commercial boiler			\$5.36 /bu		80%
Fuel Oil #1 (residential)			\$1.68 /gal		83%
Fuel Oil #2 (home use similar to diesel)			\$1.96 /gal		83%
Fuel Oil #6 (common for ships, bunker C)			\$2.12 /gal		83%
Propane			\$1.23 /gal		79%

For some of the information in a table go to

<http://www.fpl.fs.fed.us/documnts/techline/fuel-value-calculator.pdf>

Wood Energy Financial App

[Welcome](#)[Energy Costs](#)[Capital Costs](#)[Cash Flow](#)[Report](#)

Welcome



This **Wood Energy Financial App** is part of the *Community Biomass Handbook Volume I: Thermal Wood Energy* by: Dennis Becker, Eini Lowell, Dan Bihn, Roy Anderson, and Steve Taff. It is living electronic workbook and reference guide to help you answer initial project development questions about proven thermal energy options for your community or business.

For more information or questions, please visit woodenergy.umn.edu.



The financial calculator is for information and education purposes only (e.g. project guidance, scoping, and pre-feasibility assessment). It should NOT be used for investment purposes. The authors, USDA, and the Forest Service claim no responsibility for its use.

Release Candidate 1.1 April 21, 2014

<http://woodenergy.umn.edu/BiomassCalculator>

Wood Energy Financial App

Annual Fuel Cost Savings

\$1,500

Welcome

Energy Costs

Capital Costs

Cash Flow

Report

Existing Heating System

Fuel

Fuel Type

Propane ▼

Cost per Gallon ⓘ

\$1.50

Cost per MMBtu

\$16.43

MMBtu per Gallon

0.09130

Annual Fuel Usage

MMBtu per Year ⓘ

411

Gallons per Year

4,500

Annual Propane Cost

\$6,750

Existing Boiler

Boiler Type ⓘ

Conventional ▼

Efficiency (%)

80%

Annual Heat Demand

Delivered Heat (MMBtu) ⓘ

300

Substitution Percentage ⓘ

80%

Biomass Heating System

Biomass System

Biomass Type

Chips ▼

Efficiency (%) ⓘ

82%

Biomass Fuel

Moisture Content (wet) ⓘ

6%

Cost per MMBtu

\$13.52

Cost per Green Ton ⓘ

\$200

Cost per Dry Ton ⓘ

\$213

Biomass Annual Fuel Usage

Green Tons

20

Dry Tons

19

Truck Loads (25-ton loads)

1

Biomass Fuel Cost

\$4,000

Remaining Annual Fuel

Remaining Propane Cost ⓘ

\$1,000

Annual Propane Cost

\$6,750



Wood Energy Financial App

Total Capital Cost

\$178,000

Welcome

Energy Costs

Capital Costs

Cash Flow

Report

Biomass System Cost and Size Estimates

Biomass Boiler Size Estimate

MMBtu per Year (biomass)

Utilization (Months/Year) ⓘ

Utilization (percent)

System Size (MMBtu/hr) ⓘ

☒ Use Model-Driven Estimate

Biomass Boiler Cost

Boiler System Costs ⓘ

Building & Site Costs ⓘ

Total Boiler & Building Cost

Distribution Costs

Hookups

Building Hookup Costs ⓘ

Number of Buildings

Home Hookup Costs ⓘ

Number of Homes

Piping

Pipe Cost per Linear Foot ⓘ

Pipe Distance ⓘ

Total Distribution Costs

Total Distribution Costs

Annual Propane Cost

\$6,750



Wood Energy Financial App

Payback Period (years)

122.4 Years

Welcome

Energy Costs

Capital Costs

Cash Flow

Report

Financial Inputs

Financial Parameters

Total System Costs

Interest Rate ⓘ

Project Lifespan ⓘ

Outside Grants ⓘ

Operations & Maintenance Cost

O&M Costs ⓘ

O&M % of System Cost

Cost Scenarios

Biomass Cost (Green Ton) ⓘ

Propane Cost per Gallon ⓘ

Financial Results

Financial Results

Financed System Cost ⓘ

Biomass System Annual Expenses

Biomass Fuel Cost

Remaining Fuel Cost ⓘ

O&M Cost

Debt Payment ⓘ

Total Expenses

Existing System Annual Expenses

Annual Propane Cost ⓘ

Value of Adding Biomass System

Annual Net Cash Flow ⓘ

Present Value of Cash Flow ⓘ

System Cost per MMBtu ⓘ

Annual Propane Cost

\$6,750



KENTUCKY'S



GROWING GOLD

A PUBLICATION OF:
KENTUCKY DIVISION OF FORESTRY
FRANKFORT, KENTUCKY 40601

<http://forestry.ky.gov/ForestryPublications/Forestry%20Publications/Growing%20Gold%20-%20Winter%202014.pdf>

MAT LOGS	\$/MBF	
MHS	300-400	
OAK	400-800	
<i>1 Co. Reporting</i>		
CHIP LOGS	\$/MBF	
MHS	100	
<i>1 Co. Reporting</i>		
PULPWOOD		\$/TON
MHS		24
MPI		27
<i>2 Cos. Reporting</i>		

RENEWABLE ENERGY



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<http://www.argusmedia.com/Bioenergy/Argus-Biomass-Markets>

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<http://www.risiinfo.com/risi-store/do/product/detail/wood-biomass-market-report.html>

Wood Biomass Market Report



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Tim Hughes

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